

**B6.**

a) The following character encoding is used in a data link protocol:

A: 01000111  
B: 11100011  
FLAG: 01111110  
ESC: 11100000

When using the following four-character frame:

A B ESC FLAG.

Show the bit sequence transmitted (in binary) for the four-character frame for **each** of these framing methods;

- i) Byte count
- ii) Flag bytes with byte stuffing.

**(8 marks)**

b) For this data link protocol, what is the maximum overhead in a byte-stuffing algorithm?

**(3 marks)**

c) Sixteen-bit messages are transmitted using a Hamming code.

- i) How many check bits are needed to ensure that the receiver can detect and correct single-bit errors?

**(2 marks)**

- ii) Show the bit pattern transmitted for the message 1101 0011 0011 0101. Assume that even parity is used in the Hamming code.

**(8 marks)**

d) What are the **TWO** main causes of error for digital transmission systems? Illustrate your answer.

**(4 marks)**

**End of Examination**

**BCS THE CHARTERED INSTITUTE FOR IT**

**BCS HIGHER EDUCATION QUALIFICATIONS**  
**BCS Level 5 Diploma in IT**

**Wednesday 27<sup>th</sup> April 2022 - Afternoon**

**COMPUTER NETWORKS**

Answer **any** FOUR questions out of SIX. All questions carry equal marks

Time: TWO hours

**Answer any Section A questions you attempt in Answer Book A**

**Answer any Section B questions you attempt in Answer Book B**

The marks given in brackets are **indicative** of the weight given to each part of the question.

Only **non-programmable** calculators are allowed in this examination.

**Section A**  
**Answer Section A questions in Answer Book A**

**A1.**

- a) Explain what the unique characteristics of the data link layer are in comparison with the other layers of the OSI model?  
**(8 marks)**
- b) Ethernet switches operate at the data link layer.
- i) What are the **TWO** main forwarding methods used on switches?  
**(4 marks)**
- ii) Explain how each method operates with the use of supporting diagrams and frame structures.  
**(10 marks)**
- c) Explain how Layer 2 technologies are only “locally significant” when the boundary ends at the local default gateway.  
**(3 marks)**

**A2.**

- a) TCP is a transport layer protocol used for many well-known Internet applications. It uses a number of flags in its operation between client and server. Name **SEVEN** flags and how each is used in client server communication.  
**(21 marks)**
- b) Explain and justify whether TCP or UDP should be used as the transport layer of choice for reliable communication for Internet applications.  
**(4 marks)**

**A3.**

- a) What polynomial corresponds to the following bit strings?
- i) 0110010011010110  
ii) 1100110011001101  
iii) 0101010101010111  
**(9 marks)**
- b) The reference polynomial used in a CRC scheme is:  
 $x^4 + x^3 + 1$ .
- A data sequence 1010101010 is to be sent. Determine the actual bit string that is transmitted.  
**(16 marks)**

**Section B**  
**Answer Section B questions in Answer Book B**

**B4.**

- Internet Email is an asynchronous communication medium based on sent and received text and other multimedia attachments.
- a) What are the **THREE** main components of an end-to-end email system?  
**(6 marks)**
- b) What **THREE** protocols can typically be used to access stored user emails on a server component from a client computer?  
**(6 marks)**
- c) What are the typical limitations of the email protocols used in both the sending and receiving of email messages?  
**(3 Marks)**
- d) With supporting diagrams, explain how an email can be sent from a typical client system and be routed through several different servers and received by an end client.  
**(10 marks)**

**B5.**

- a) Outline the key differences between packet switching and circuit switching networks?  
**(8 marks)**
- b) Why does a technology such as ATM choose the use of cells over the use of packets?  
**(8 marks)**
- c) What parameters does ATM use to achieve Quality of Service?  
**(9 marks)**